

WHAT IS CLAIMED IS:

1. A vibration wave actuator apparatus which excites a vibration member and obtains a driving force by applying a frequency signal to a driving
5 electro-mechanical energy conversion element mounted on the vibration member, comprising:

a driven state detecting unit which detects a vibration state of the vibration member, said driven state detecting unit including a monitor unit which
10 outputs a waveform signal having an amplitude corresponding to the vibration state of the vibration member, a pulse width forming circuit which forms a pulse width signal by comparing a signal from said monitor unit with a threshold, and a determining
15 circuit which determines the driven state in accordance with the pulse width.

2. An apparatus according to claim 1, wherein said comparing circuit comprises a plurality of
20 circuits having different thresholds, and said pulse width forming circuit forms a pulse width signal having a value corresponding to a comparison result from each of said comparing circuits.

25 3. An apparatus according to claim 2, wherein said determining circuit selects a predetermined pulse width signal of the pulse width signals, and determines

10025500 122001

a vibration state in accordance with the selected signal.

4. An apparatus according to claim 3, wherein
5 said determining circuit selects a pulse width signal of the pulse width signals which has a minimum value other than 0.

10025220-122001
5. An apparatus according to claim 1, wherein
10 said apparatus further comprises a converting circuit which converts a signal from said monitor unit into a plurality of signals having different values, said pulse width forming circuit includes a comparing
15 circuit comparing the respective converted signals, and said pulse width forming circuit forms a pulse width signal having a value corresponding to each comparison result from said comparing circuit.

6. An apparatus according to claim 5, wherein
20 said determining circuit selects a predetermined pulse width signal of the pulse width signals, and determines a vibration state in accordance with the selected signal.

25 7. An apparatus according to claim 6, wherein said determining circuit selects a pulse width signal of the pulse width signals which has a minimum value

other than 0.

8. A control apparatus for a vibration wave actuator including a driving unit which forms driving vibrations in a vibration member by applying a frequency signal to an electro-mechanical energy conversion element mounted on the vibration member, and a driven state detecting unit which detects a driven state of the vibration member, wherein

10 said driven state detecting unit comprises a state detecting unit which detects a driven state of the vibration member and outputs a waveform signal having an amplitude corresponding to the driven state, a comparing circuit which compares an output waveform signal from said state detecting unit with one or a plurality of thresholds and outputs a pulse signal, a pulse width detecting circuit which detects a pulse width or pulse widths of one or a plurality of pulse signals output from said comparing circuit, and a determining circuit which determines the driven state in accordance with one or a plurality of pulse widths detected by said pulse width detecting circuit.

9. A control apparatus for a vibration wave actuator including a driving unit which forms driving vibrations in a vibration member by applying a frequency signal to an electro-mechanical energy

conversion element mounted on the vibration member, and a driven state detecting unit which detects a driven state of the vibration member, wherein

5 said driven state detecting unit comprises a state detecting unit which detects a driven state of the vibration member and outputs a waveform signal having an amplitude corresponding to the driven state, a multiplying circuit which multiplies the output waveform signal from said state detecting unit by one
10 or a plurality of coefficients, a comparing circuit which compares one or a plurality of multiplication signals obtained by said multiplying circuit with one or a plurality of thresholds and outputs a pulse signal, a pulse width detecting circuit which detects
15 one or a plurality of pulse signals output from said comparing circuit, and a determining circuit which determines the driven state in accordance with one or a plurality of pulse widths detected by said pulse width detecting circuit.

20

10. An apparatus according to claim 8, wherein said determining circuit determines a vibration amplitude of the waveform signal in accordance with the pulse width.

25

11. A control apparatus for a vibration wave actuator including a driving unit which forms driving

vibrations in a vibration member by applying a frequency signal to an electro-mechanical energy conversion element mounted on the vibration member, and a driven state detecting unit which detects a voltage applied to the electro-mechanical energy conversion element of the vibration member, wherein

said driven state detecting unit comprises a comparing circuit which compares the applied voltage with one or a plurality of thresholds and outputs a pulse signal, a pulse width detecting circuit which detects a pulse width one or a plurality of pulse signals output from said comparing circuit, and a control circuit which increases/decreases the applied voltage in accordance with one or a plurality of pulse widths detected by said pulse width detecting circuit.

12. A control apparatus for a vibration wave actuator including a driving unit which forms driving vibrations in a vibration member by applying a frequency signal to an electro-mechanical energy conversion element mounted on the vibration member, and a driven state detecting unit which detects a voltage applied to the electro-mechanical energy conversion element of the vibration member, wherein

said driven state detecting unit comprises a multiplying circuit which multiplies the applied voltage by one or a plurality of coefficients, a

comparing circuit which compares one or a plurality of multiplication signal obtained by said multiplying means with one or a plurality of thresholds, and outputs a pulse signal, a pulse width detecting circuit which detects a pulse width of one or a plurality of pulse signals output from said comparing circuit, and a control circuit which increases/decreases the applied voltage in accordance with one or a plurality of pulse widths detected by said pulse width detecting circuit.

13. A control apparatus for a vibration wave actuator including a driving unit which forms driving vibrations in a vibration member by applying a frequency signal to an electro-mechanical energy conversion element mounted on the vibration member, and a driven state detecting unit which detects a voltage applied to the electro-mechanical energy conversion element of the vibration member, wherein

said driven state detecting unit comprises a state detecting circuit which detects a vibration amplitude of the vibration member or an inflow current to the electro-mechanical energy conversion element and outputs a detection result as a waveform signal, a first comparing circuit which compares the output waveform signal from said state detecting circuit with one or a plurality of thresholds and outputs a first pulse signal, a first pulse width detecting circuit

which detects a pulse width of the first pulse signal,
a second comparing circuit for comparing the applied
voltage with one or a plurality of thresholds and
outputs a second pulse signal, a second pulse width
5 detecting circuit which detects a pulse width of the
second pulse signal, a phase difference detecting
circuit which detects a phase difference between the
first pulse signal and the second pulse signal, and a
control circuit which, when an output from said first
10 pulse width detecting circuit is larger than a
predetermined value, controls the frequency signal in
accordance with a phase difference detecting result
from said phase difference detecting circuit.

10022520-122001